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(54) **An automatic magneto-thermal protection switch having a high breaking capacity.**

(57) An automatic, high breaking capacity magneto-thermal protection switch or breaker of a type comprising a control key (3), a toggle mechanism (16) associated with the key, at least one moving contact (18) driven by the mechanism to rock toward and away from a fixed contact (18) facing a de-ionization chamber (30) and respective cell (29), and an amperometric protection coil (9) having a moving armature (12) arranged to act on said mechanism, further comprises a rocking striker (32) having one end (33) inserted in the path of movement of a breaker arm-like lug (35) on said armature and the opposite end arranged to act on said moving contact (18) in abutment relationship to speed up the contact opening movement by the time of automatic operation.

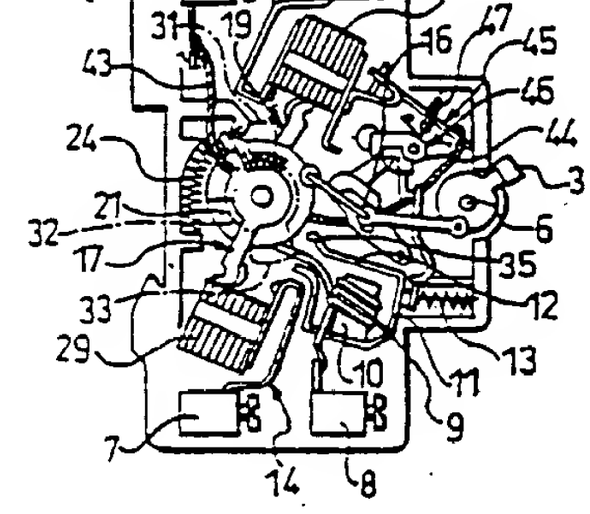

FIG.3

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This invention relates to an automatic magneto-thermal protection switch having a high breaking capacity and being of a type which comprises a control key, a toggle mechanism associated with the key, at least one moving contact operated through said mechanism to rock toward and away from a fixed contact facing a deionization chamber and respective cell, and an amperometric protection solenoid having its moving armature arranged to act on said mechanism.

As is well known, automatic switches or breakers of the above-outlined type are widely employed in the civil and tertiary sectors to perform control and protection functions for an electric system.

They are installed, for example, upstream of an electric power distribution line to which a number of consumer apparatus are connected. These switches enable the line to be sectioned off other lines in the system, while also affording magneto-thermal protection for such apparatus against overloading, fault currents, and shorts.

For that field of application, relevant regulatory bodies (CEI Standard 23-3) provide for these switches to have a breaking capacity at 220 Volts rated at 3-4.5 kiloamperes in a short situation.

When conformant with this standard, the switch will be able to adequately protect resistive loads as are usually to occur in generic domestic and civil systems.

A current demand is also that of providing modular switches of still smaller size and bulk so that an increased number of them can be accommodated within a station panel. This demand is more acutely felt where the protection for existing systems is to be enhanced and the space available for the station panel is limited.

The trend is, with most of the manufacturers, toward the provision of protection switches or breakers which are incorporated to a single standard module 17.5 mm wide. However, this brings about some serious design problems if the break mechanism and the switch protection devices are both to fit in that module. In addition, to conform with the aforesaid standard, it is necessary that on the occurrence of a short, the electric arc that is unavoidable generated across the fixed and moving contacts of the switch be effectively suppressed within the shortest possible time. But this requires de-ionization chambers of adequate size and considerable bulk, which runs contrary to the need to fit the whole assembly in a single standard module.

It will be appreciated, moreover, how these problems are aggravated where automatic switches or breakers are to be provided which are of the so-called single-pole type with neutral, and require that two ionization chambers be accommodated within said standard module, respectively for the phase contacts and the ones associated with the neutral pole.

The technical problem that underlies this invention is to provide an automatic magneto-thermal protection switch which has such structural and functional characteristics as to permit of the use of uniquely small-size de-ionization chambers, so that the switch can comfortably fit inside a single standard module, and still retain a high breaking capacity, while overcoming the drawbacks with which the prior art is beset.

The solutive idea on which this invention stands is that of increasing the opening and separation speed of the moving contact relatively to the fixed contact, upon automatic operation of the switch, thereby the size of the de-ionization cells can be reduced.

On the basis of this idea, the technical problem is solved by an automatic switch of the type specified above being characterized in that it comprises a rocking striker having one end in the path of movement of a breaker arm-like lug on said armature and the other end arranged to abut on said moving contact, to thereby speed up the contact opening movement by the time of automatic operation.

The features and advantages of an automatic switch according to the invention will become apparent from the following detailed description of an embodiment thereof, to be taken by way of illustration and not of limitation in conjunction with the accompanying drawings.

In the drawings:

Figure 1 shows in perspective the outward appearance of an automatic switch according to the invention;

Figure 2 is a perspective view of the construction of the switch shown in Figure 1;

Figure 3 is a top plan view of the switch if Figure 2; and

Figure 4 is a perspective detail view of the switch shown in Figure 2.

With reference to the drawing views, generally indicated at 1 is an automatic magneto-thermal protection switch or breaker according to the invention.

The switch 1 comprises a box-type case 2 of parallelepipedic shape, known per se, which measures 17.5 mm in width.

The case 2 is formed of two superimposed half-shells 4 and 5 having mating shapes.

The switch 1 also comprises a control key 3, of the bistable kind, which is accessible frontally on the case 2 and journalled on a pin 6 fast with the half-shell 5.

Connected to the key 3 is a break mechanism, generally denoted by 15, comprising a toggle mechanism 16 for driving a moving contact to rock toward and away from a corresponding fixed con-

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tact.

The switch 1 is of the so-called single-pole type with neutral, and input and output fixed-cage terminals 7 and 8 are provided therefor to enable connection to neutral and phase conductors, respectively.

To the phase inout terminal 8, there is connected one end of an amperometric coil 9 intended for automatic magnetic protection operation and wound around a stationary core 10.

The coil 9 is carried in a U-shaped cage 11 having sheet-like walls and, pivoted to its top, a small moving armature 12 bent at right angles to define a first leg extending over the core 10 and a second leg 12a having an end arranged to interfere with and act upon, with the interposition of a small lever 46, the breaking mechanism 15. The end of the first leg of the armature 12 has a breaker arm-like lug 35 serving a function to be explained.

The armature 12 is apt to be pulled toward the core 10 by the electromagnetic force induced by a fault or short current such that the end active on the mechanism 15 can automatically trip off the switch 1 on the occurrence of a fault situation.

Respectively associated with the neutral input terminal 7 and the phase output terminal 8 are fixed contacts 14 and 18, toward and away from which, corresponding moving contacts 17 and 19 are guided movably by the mechanism 15.

A moving contact holder assembly 20 is provided for the purpose which comprises a drum 21 journalled on a pin 22 fast with the half-shell 5.

The drum 21 is connected peripherally to one end of the toggle mechanism 16 and displaceable angularly against the bias force of a spring means 24.

Mounted resiliently on said drum 21, to opposed faces thereof, are the aforesaid moving contacts 17 and 19. More particularly, with reference to Figure 4, each contact, 17 or 19, comprises an annular sheet-like portion 25 fitting around the pin 22 in a mating seat 29 formed in the drum 21 and being held therein against the bias of a spring 27.

Formed integrally with the portion 25 is an arm 28 carrying the moving contact and jutting out toward the corresponding fixed contact opposite to a de-ionization chamber 30 and respective cell 29.

The cells 29 are provided on opposed sides of the switch 1 near the fixed contacts 14 and 18; they are arranged substantially along a slightly inclined direction to the major axis of the switch.

Each cell 29 consists of a set of laminations 36 thickly arranged parallel and attached to one another by small opposed cross-bars 37. These laminations 36 have a V-shaped cutout 38 formed in their side facing the moving contact, whereby a corresponding V-like notch is defined which provides an invitation for the electric arc to be suppressed.

The spring 27 controls the contact force between the corresponding fixed and moving contacts, while taking up any backlash generated by the contact wear.

The respective arms 28 of the contacts 17 and 19 extend substantially from opposed ends of the drum 21, and are aligned along the same direction but opposite verses. They are displaceable angularly together with the drum 21 in the same direction of rotation.

A cord lead 43 connects the portion 25 of the moving contact 17 to the output terminal 7, and a similar cord lead 44 connects the portion 25 of the other moving contact 19 to the end of a bimetallic plate 45. This plate 45 has the opposite end connected to the other end of the coil 9, being thus connected in series between that coil and the moving contact 19 to provide thermal protection for the switch 1.

A small, three-arm lever 46 is journalled for the purpose on a pin 48 rigid with the half-shell 5 and displaceable angularly against the bias force of a spring 47. That lever 46 has a first arm acting as feeler on the bimetallic plate 45, a second arm inserted in the path of travel of the section 12a of the armature 12, and a third arm connected detachably to the breaking mechanism 15.

Advantageously, a rocking striker 32 is also provided which is journalled on the pin 22 above the drum 21 and has opposite ends 31 and 33 respectively located close against each arm 28, thereby the rocking striker 32 will form with the arms 28 a cross-over X-shaped configuration.

The rocking striker 32 has its end 33 inserted in the path of travel of the breaker arm-like lug 35 on said armature 12 and the opposite end 31 active on the arm 28 of the moving contact 19 in abutment relationship.

That same end 33 of the rocking striker 32 is active, on account of the thrust force applied to it by the lug 35 on operation of the coil 9, on the arm 28 of the moving contact 17.

This concurrent striking effect on the moving contacts 17 and 19 allows the opening of the contacts to be speeded up upon automatic operation of the switch 1.

The switch 1 is also provided with an indicator device 40 indicating the operational state of the switch. This device comprises a rod 39 pivoted between the drum 20 and the toggle mechanism 16 and extending to the key 3.

To the end of said rod 39, there is attached a small indicator plate 42 in two colors which can be viewed through a window 41 provided in the case 2 front above the key 3.

Thus, automatic operation of the protection switch according to the invention is made easier by

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the peculiar construction of the moving contact holder assembly arranged to co-operate with the rocking striker 32. The latter can strike the opposed arms 28 of the respective moving contacts 17 and 19 simultaneously and impart a higher angular acceleration to the drum 20 on the occurrence of an automatic switch operation.

The striking effect adds to the elastic pull from the spring 24, with the result that the speed of relative movement of the fixed and moving contacts away from each other can be higher than that afforded by switches made in accordance with the prior art.

This enables de-ionization chambers and their cells to be provided in uniquely small sizes, such that the remaining parts can find room within the DIN standard module of the switch in a proper structural layout effective to facilitate assembly procedures.

Claims

1. An automatic magneto-thermal protection switch (1) having a high breaking capacity and being of a type which comprises a control key (3), a toggle mechanism (16) associated with the key, at least one moving contact (19) operated through said mechanism to rock toward and away from a fixed contact (18) facing a de-ionization chamber (30) and respective cell (29), and an amperometric protection solenoid (9) having its moving armature (12) arranged to act on said mechanism; characterized in that it comprisesa rocking striker (32) having one end (33) in the path of movement of a breaker arm-like lug (35) on said armature and the other end (32) arranged to abut on said moving contact (19), to thereby speed up the contact opening movement by the time of automatic operation.

2. A switch according to Claim 1, characterized in that it comprises a pair of moving contacts (17,19) in a single-pole configuration with neutral, being mounted on a contact holder assembly (20) consisting of a drum (21) journalled on a pin (22) and peripherally connected to one end of said toggle mechanism (16).

3. A switch according to Claim 2, characterized in that said contacts (17,18) jut out from opposite sides of said drum (20).

4. A switch according to Claim 2, characterized in that each moving contact (17,19) includes a sheet-like annular portion (25) fitting around said pin (22) in a mating seat (26) formed in one face of the drum (21) and being held therein by a spring (27), formed integrally with said portion there being an arm (28) for supporting the corresponding moving contact.

5. A switch according to Claim 2, characterized in that it comprises an indicator device (40) for indicating the operational state of said switch and being provided with a rod (39) journalled between said drum (20) and the toggle mechanism (16) and extending to said key (3), to the end of said rod there being attached a small indicator plate (42) in two colors which can be viewed through a window (41) provided on the front of the switch case.

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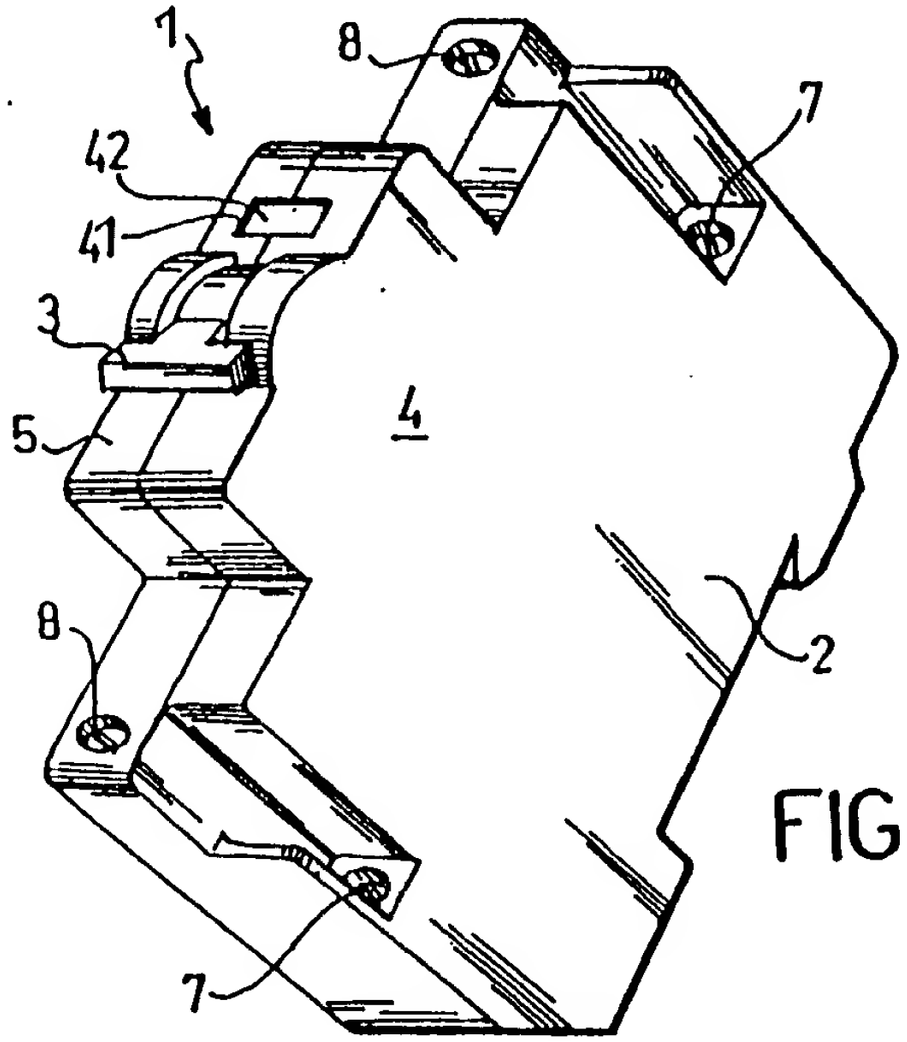

FIG.1

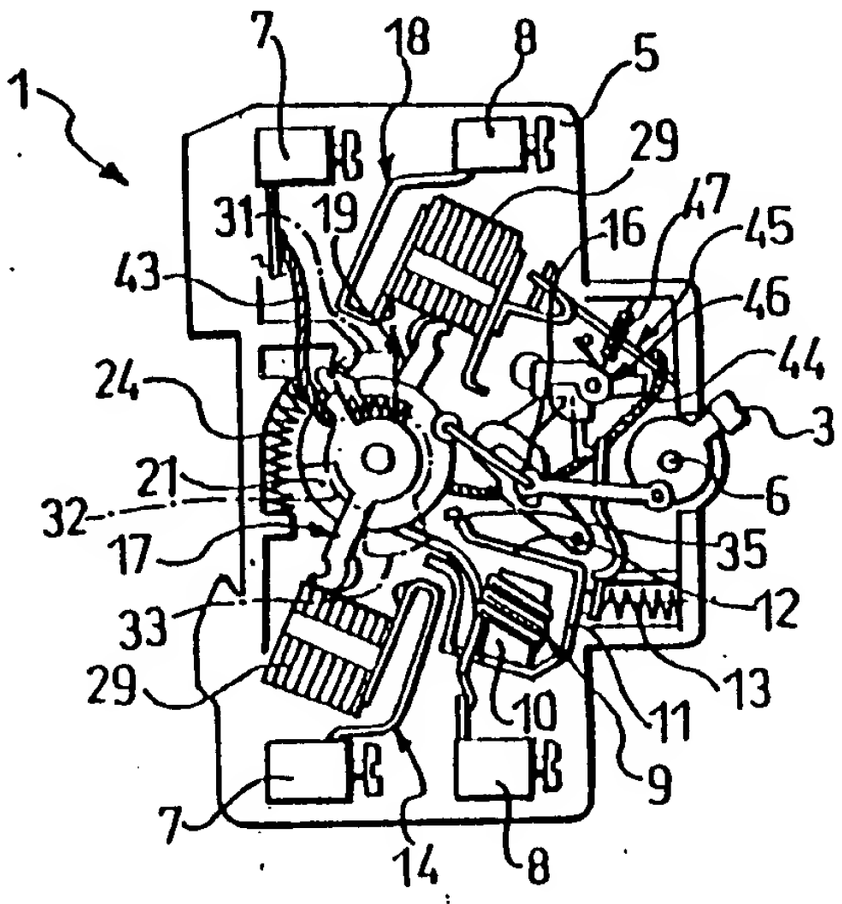

FIG.3

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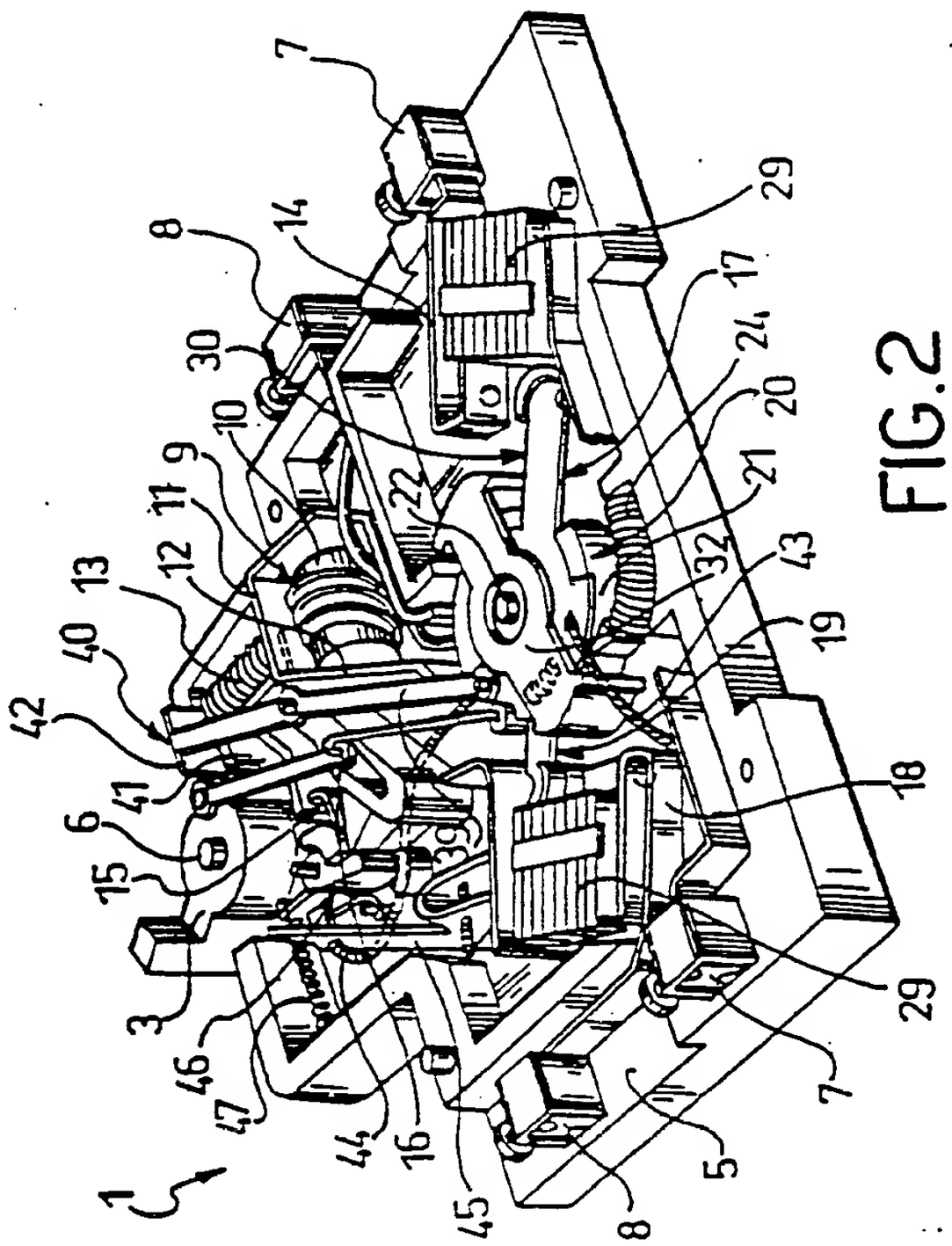
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FIG.2

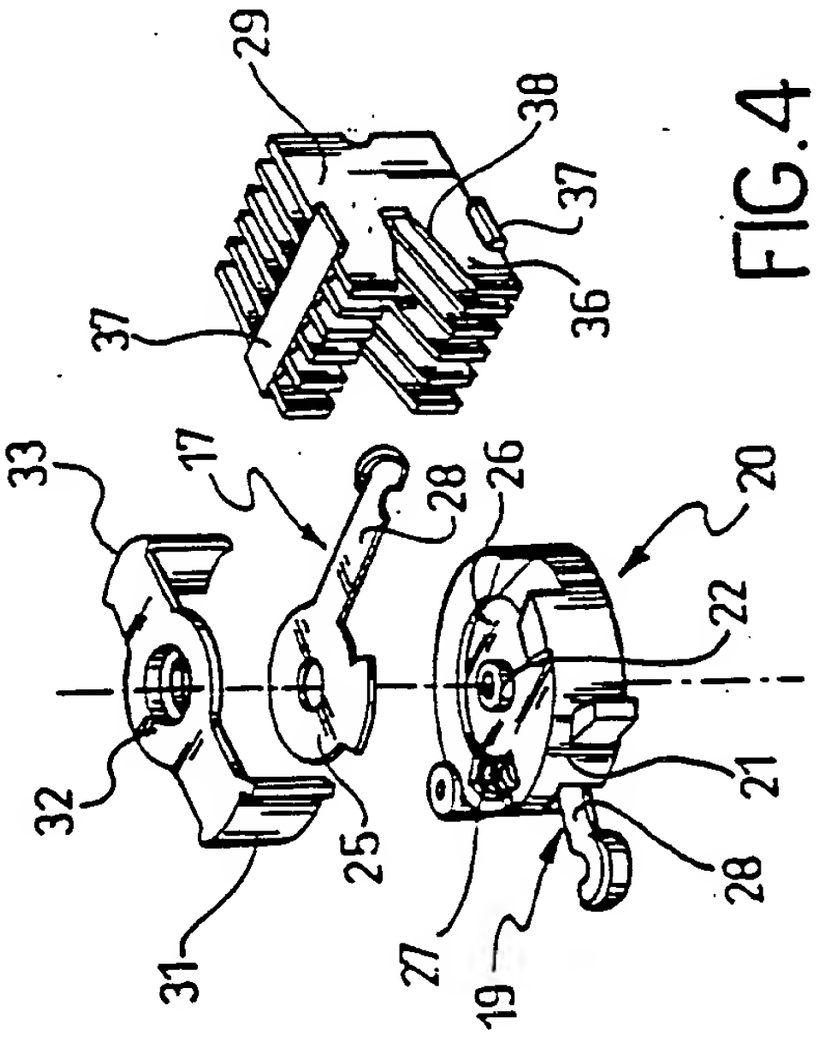

FIG.4